BINDURA UNIVERSITY OF SCIENCE EDUCATION

DIPLOMA IN SCIENCE EDUCATION

JUN 202

MT006: Statistics 11/

DM006: Inferential statistics

Time: 2 hours

Candidates may attempt ALL questions in Section A and at most TWO questions in Section B. Each question should start on a fresh page.

SECTION A (40 mark)

Candidates may attempt ALL questions being careful to number them A1 to A5.

A1. Define the terms

(a) Independent variable [2]
(b) Dependent variable [2]
(c) Parameter [2]
(d) Statistics [2]
(e) Statistic [2]

A2. Draw a sketch diagram for each of the following, indicating the position of the mean, mode and median;

(a) normal distribution [3]
(b) positively skewed-distribution [3]
(c) negatively skewed distribution [3]

A3. The birth weight of babies is normally distributed with mean 3500g and standard deviation 500g. What is the probability that a baby is born that weighs less than 3100g? [10]

A4. A radioactive source emits particles at an average rate of 25 particles per second. What is the probability that in 1 second the count is less than 27 particles? [10]

A5. Differentiate descriptive statistics from inferential statistics [1]

SECTION B (60 marks)

Candidates may attempt TWO questions being careful to number them B6 to B8

B6.

a) The marks of 500 candidates in an examination are normally distributed with a mean of 45 marks and a standard deviation of 20 marks. If 5 % of candidates obtain a distinction by scoring x marks or more, estimate the value of x. [10]

b) According to a particular genetic theory the number of color strains, pink, white and blue in a certain flower should appear in the ratio 3:2:5. In 100 randomly selected plants, the corresponding numbers for each were 24, 14 and 62. Test at 1% level that whether the differences between observed and expected frequencies are significant. [10]

c) Mercury makes a 2.4 liter V-6 engine, used in speedboats. The company's engineers believe the engine delivers an average horsepower of 220 HP and that the standard deviation of power delivered is 15 HP. A potential buyer intends to sample 100 engines. What is the probability that the sample mean will be less than 217 HP? [10]

B7.

a) In recent years, convertible sports coupes have become very popular in Japan. Toyota is currently shipping Celicas to Los Angeles, where a customizer does a roof lift and ships them back to Japan. Suppose that 25% of all Japanese in a given income and lifestyle category are interested in buying Celica convertibles. A random sample of 100 Japanese consumers in the category of interest is to be selected. What is the probability that at least 20% of those in the sample will express an interest in a Celica convertible? [10]

b) A sample of 11 pints has a mean calorie content per 100 ml of 35.9, with a standard deviation of 2.35. Determine a 95% confidence interval for the true mean calorie content per 100 ml Guiness if the calorie content is normal. [10]

c) A random sample of 100 people shows that 25 are left-handed. Form a 95% confidence interval for the true proportion of left-handers. [10]

B8.

a) A manufacturer of light bulbs claims that the mean lifetime of the bulbs is 500 hours. In a simple random sample of 40 light bulbs, the mean lifetime is 483.75 hours and the standard deviation is 26.35 hours.

(i) Is there any evidence that the mean lifetime is different from 500 hours at 0.10 significance level? [10]

(ii) Which graphical display would be the best to present the data? [2]

(iii) Considering the results of the hypothesis test, decide which of the Type I or Type II errors is possible, and describe this error. [3]

(iv) Decide whether H_0 would have been rejected or would not have been rejected with each of the following significance levels: $\alpha = 0.01$, $\alpha = 0.05$ [6]

(v) What would the presence of one or more outliers in the data suggest about using the t statistic? [3]

(vi) Explain three factors that affect the power of a test. [6]

(vii) State two estimation methods. [2]

END OF PAPER